BR 2.2 (#30)
4.0

ANCHORAGE WATER & WASTEWATER UTILITY

3000 Arctic Boulevard
Anchorage, Alaska 99503
(907)

Tony Knowles
Mayor

Owned by the Municipality
of Anchorage

March 1, 1985

RECEIVED MAR 7 1985

Midwest Research Institute
4505 Creedmoor Rd., Suite 202
Raleigh, North Carolina 27612

Attention: Mr. Richard Cooper

RE: Sludge Incinerator Emmissions Report

Mr. Cooper:

Attached please find a copy of our most recent incinerator emmissions analysis which you requested for your survey. You additionally requested the geographic location of the facility. This informaion is as follows:

Latitude: 61°, 12' North
Longitude: 150°, 2' West

If I may be of further assistance please write or call me at (907) 243-2151.

Sincerely,

J. Kris Warren

J. KRIS WARREN
Superintendent
Wastewater Treatment
Anchorage Water & Wastewater Utility

JKW/tls

American Services Associates
Consultants in Air, Water, Energy, Hygiene & Management

May 24, 1984

Mr. J. Kris Warren
ANCHORAGE WATER & WASTEWATER UTILITY
P.O. Box 6285
Anchorage, Alaska 99502-2085

Dear Kris,

Re: Clarifications-4/84 Pt Woronzof Sludge Incinerator Test

Our conference call conversation with Bill MacClarence of the Alaska Department of Environmental Conservation (ADEC) brought up the need for clarification of the following elements on the subject report. I apologize that the subject report requires these clarification comments.
1. How the atmospheric emissions were corrected to a carbon dioxide concentration of 12% less the contribution from auxiliary fuel (i.e. natural gas in the case of Pt. Woronzof Sewage Sludge Incinerator).
2. How the flowrate of shaft cooling air was determined.
3. How to determine if carbon dioxide is being absorbed in the scrubber which thereby increases the reported particulate emissions.

Particulate Emission Corrections to 12% Carbon Dioxide

Particulate emissions on combustion sources can be diluted with air to meet emission standards based upon concentration bases. The correction to 12% carbon dioxide was developed to prevent air dilution as a means to get combustion sources to dilute with ambient air as a means to meet the particulate emission standard (i.e. "Dilution is NOT the Solution to Pollution").

The correction of particulate emissions from combustion sources to 12% carbon dioxide is based upon burning bituminous coal with 50% more air than is required for theoretically perfect combustion (Theoretically perfect burning of bituminous coal will produce 18% carbon dioxide in the exhaust gas). At the time the 12% carbon dioxide standard was developed, 50% excess air was an acceptable quantity of excess air to satisfactorily burn bituminous coal. The particulate emissions from conmbustion sources are measured and no correction is made if the carbon dioxide in the exhaust stack is 12%. If the exhaust gas concentration of the stack is 6% carbon dioxide, the combustion source burning bituminous coal is diluting with air (i.e. 100% excess air) so the particulate emissions are "corrected" to 12% carbon dioxide by a factor (i.e. 12/measured % carbon dioxide in the exhaust gas stack) to correct the exhaust gas back to 12% carbon dioxide and 50% excess air.

Combustion sources burn with supplemental fuel (i.e. auxiliary fuel) to perform special operations such as ignite the material being burned, raise the temperature in an afterburner to maintain a high temperature for combustion to be completed, evaporate water so the material will burn. The auxiliary fuel contributes carbon dioxide to the exhaust gas. Because the auxiliary fuel used in afterburners or in the burners of incinerators is assumed to burn efficiently and completely but contributes carbon dioxide to the exhaust gases, the quantity of carbon dioxide in the exhaust gases must be known and subtracted from the carbon dioxide in the exhaust gas from the material being burned to determine the particulate emissions from the material being burned.

Auxiliary fuel is typically natural gas which is composed of 95% to 98% methane (i.e one part carbon combined with four parts hydrogen-CH4). Methane will burn completely in an incinerator and produce one part carbon dioxide (i.e. CO2) for each one part of methane burned. Assuming that all of the auxiliary fuel is methane, that the fuel burns completely and that 24,500 cubic feet/day (i.e. 17 cubic feet per minute) was burned while the samples were being collected, then 17 cubic feet of methane was produced in the exhaust stack from the auxiliary fuel. The resulting carbon dioxide contribution in the exhaust gas from the auxiliary fuel is therefore 17 cubic feet per minute (i.e. standard cubic foot at 68 degrees F, one atmosphere pressure and dry). Using an average exhaust gas airflow of 5012 standard cubic feet per minute, the percent carbon dioxide from the auxiliary fuel is therefore: 17X100/5012 = 0.34% carbon dioxide from auxiliary fuel
The 0.35% was subtracted from the measured carbon dioxide for each run (i.e. 5.66, 5.57 & 5.53% for Run Nos 1, 2 & 3 respectively) to arrive at the carbon dioxide from the material being burned of 5.32,5.23 & 5.19% for Run Nos. 1, 2 & 3 respectively. The particulate emission correction to 12% carbon dioxide for each run was therefore 12/5.32, 12/5.23 and 12/5.19 for Run Nos 1, 2 & 3 respectively.

A more accurate analysis of the carbon dioxide contribution from the auxiliary fuel can be made from a reference provided by Mr. Bill MacClarence of ADEC if the composition of the natural gas is known. A copy of the procedure provided by Mr. MacClarence is enclosed as Reference No. 1. to this clarification.

Shaft Cooling Airflow Determination

The incinerator shaft is cooled with air (i.e. shaft cooling air) provided from a separate fan below the incinerator. The cooling air is then mixed with the incinerator exhaust gas (i.e. after the induced draft (I.D.) fan which pulls the exhaust gas out of the incinerator and through the scrubber) and exhausts through the roof and into the stack where the particulate samples were collected.

The quantity of air in the exhaust gases that was contributed from the shaft cooling air fan is necessary to know because it affects the opacity (i.e the density of smoke) from the incinerator. The opacity meter is located at the scrubber outlet ahead of the shaft cooling air entrance point. The opacity meter is therefore reading a darker opacity than the stack exhaust. The temperature increases from approximately 60 degrees F at the scrubber outlet to 135 degrees F (from mixing with the over 400 degrees F shaft cooling air) at the stack also reduces the opacity at the outlet of the stack.

The quantity of shaft cooling air was determined by performing a mathmatical balancing of the oxygen and air entering the stack from the two sources (i.e. air from the incinerator outlet and shaft cooling). Oxygen readings were taken with a Honeywell A7001 analyzer at the induced draft fan outlet and in the exhaust stack where the samples were collected. Knowing that the oxygen concentration of the dilution air is 21%, the total airflow is 5012 dscfm, the average oxygen at the incinerator exhaust fan outlet was 13.65%, the average oxygen concentration at the stack was 15.88% and balancing the oxygen and air with the two equations listed below, the quantity of dilution air was determined.

EQ 1. Incin Air + Dil Air = Stack Air = I + D = 5012 dscfm
EQ 2, Incin O2 + Dil O2 = Stack O2 = (0.1588)(5012) = 795.9
(I)(0.1365) + (D)(0.21) = 795.9 with D = 5012 - I
Therefore, D = 1521 dscfm

The effect of dilution air on the emissions is accounted for in the correction to 12% carbon dioxide. Therefore the dilution air was not utilized to calculate an adjusted particulate emission concentration.

Carbon Dioxide Scrubber Absorption Effects on Emissions

Carbon dioxide can be absorbed in scrubber water which reduces the measured carbon dioxide concentration at the stack and therefore the 12% carbon dioxide correction factor is larger and the calculated particulate emission is larger. Mr. MacClarence of ADEC provided a reference (i.e. Reference No. 2 enclosed) to account for the absorption of carbon dioxide by the scrubber. Airflow and carbon dioxide before the scrubber were not measured on this project and because the particulate emissions were exceptionally low, the calculation of an adjusted carbon dioxide concentration was not performed. Mr. MacClarences' interest in accuracy in particulate emission concentration and opacity is to be commended in finding and providing the enclosed Reference No.2. The measurement of carbon dioxide will be made simultaneously at the scrubber inlet and the stack on the next particulate emission sample to determine the significance of the scrubber absorption of carbn dioxide.

The above observations have been made to clarify the subject report. I apologize that the subject report was not clear enough for the layman to understand and will endeavor to make future reports more clear. What specific report improvements would make the subject report more clear to the layman?

Yours truly,
AMERICAN SERVICES ASSOCIATES
dba ASA CONSULTANTS

Wesley D. Snowden, P.E.

enclosures:

cc: Mr. Bill MacClarence
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
437 E Street
Anchorage, Alaska 99501

REFERENCE No. 1 - CO2 from Natural Gas Auxiliary Fuel
(Provided by courtesy of Mr. Bill MacClarence of ADEC-5/84)

COMBUSTION CALCULATION FOR NATURAL GAS

	Fuel Analysis, Percent by Volume as Fired		ft³/ft³ of combustible required for combustion				required for combustion moles/100 moles Fuel @ 100 percent total air	
			O_2		Air		O_2	Dry Air
CH_4	94.6	x	2.0	and x	9.528	=	189.2	901.3
C_2H_6	3.0		3.5		16.675		10.5	50.025
C_3H_8	0.5		5.0		23.821		2.5	11.911
C_4H_{10}	0.5		6.5		30.967		3.25	15.484
C_5H_{12}	0.2		8.0		30.114		1.6	6.023
N_2	0.7			-			-	-
CO_2	0.5			-			-	-
	100						207.05	984.743

$$\text{Total Air} = \left[100\right]\left[\frac{\dfrac{(4407.0 + 4739.9 + 4240.5)}{3}\ \text{SCFM exhaust} - 29.1\ \text{SCFM nat. gas}}{29.1\ \text{SCFM natural gas}}\right]$$

= 15234.9 percent

	Moles/100 Moles Fuel @ 15234.9% Total Air	
	O_2	Dry Air
O_2 and $\frac{\text{dry}}{\text{air}} \times \frac{15234.9\%}{100\%}$, total =	31543.9	150024.6
Excess air = 150024.6 - 984.7	-	149039.9
Excess O_2 = 31543.9 - 207.1	31336.8	-

Products of Combustion

	CH_4	C_2H_6	C_3H_8	C_4H_{10}	C_5H_{12}	N_2	CO_2	H_2O*	Moles/100 Moles Fuel @ 15234.9 percent Total Air	Percent by Volume Dry Basis
CO_2	94.6x1	3.0x2	0.5x3	0.5x4	0.2x5	---	0.5	--	105.6	0.07
H_2O	94.6x2	3.0x3	0.5x4	0.5x5	0.2x6	---	---	1379.5	1583.4	--
N_2	(150024.6 x 0.79)					0.7	---	---	118520.1	79.03
O_2	(excess)								31336.8	20.90
									151545.9	
Wet/Dry = 151545.9 - 1583.4									149962.5	100.00

*Moles H_2O in air:

$$\frac{149039.9\ \text{Moles air}}{100\ \text{Moles Fuel}} \times \frac{28.77\ \text{lb air}}{\text{mole air}} \times \frac{.0058\ \text{lb}\ H_2O}{\text{lb air}} \times \frac{\text{Mole}\ H_2O}{18.02\ \text{lb}\ H_2O} = \frac{1379.5\ \text{moles}\ H_2O}{100\ \text{Moles Fuel}}$$

REFERENCE No. 2 - CO2 Adjustment from Scrubber Absorption
(Provided by courtesy of Mr. Bill MacClarence of ADEC-5/84)

(3) The minimum data requirements have or have not been met; or, the minimum data requirements have not been met for errors that were unavoidable.

(4) Compliance with the standards has or has not been achieved during the reporting period.

(h) For the purposes of the reports required under § 60.7, periods of excess emissions are defined as all 6-minute periods during which the average opacity exceeds the applicable opacity standards under § 60.42a(b). Opacity levels in excess of the applicable opacity standard and the date of such excesses are to be submitted to the Administrator each calendar quarter.

(i) The owner or operator of an affected facility shall submit the written reports required under this section and subpart A to the Administrator for every calendar quarter. All quarterly reports shall be postmarked by the 30th day following the end of each calendar quarter.

(Sec. 114, Clean Air Act as amended (42 U.S.C. 7414).)

Subpart E—Standards of Performance for Incinerators

§ 60.50 Applicability and designation of affected facility.

[42 FR 37936, July 25, 1977]

(a) The provisions of this subpart are applicable to each incinerator of more than 45 metric tons per day charging rate (50 tons/day), which is the affected facility.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

§ 60.51 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Incinerator" means any furnace used in the process of burning solid waste for the purpose of reducing the volume of the waste by removing combustible matter.

(b) "Solid waste" means refuse, more than 50 percent of which is municipal type waste consisting of a mixture of paper, wood, yard wastes, food wastes, plastics, leather, rubber, and other combustibles, and noncombustible materials such as glass and rock.

(c) "Day" means 24 hours.

§ 60.52 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this part shall cause to be discharged into the atmosphere from any affected facility any gases which contain particulate matter in excess of 0.18 g/dscm (0.08 gr/dscf) corrected to 12 percent CO_2.

[39 FR 20790, June 14, 1974]

§ 60.53 Monitoring of operations.

(a) The owner or operator of any incinerator subject to the provisions of this part shall record the daily charging rates and hours of operation.

[39 FR 20790, June 14, 1974]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 7414).)

§ 60.54 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.52 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis and calculation of excess air, using the integrated sample technique.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be 0.85 dscm (30.0 dscf) except that smaller sampling times or sample volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) If a wet scrubber is used, the gas analysis sample shall reflect flue gas conditions after the scrubber, allowing for carbon dioxide absorption by sampling the gas on the scrubber inlet and outlet sides according to either the procedure under paragraphs (c)(1) through (c)(5) of this section or the procedure under paragraphs (c)(1), (c)(2) and (c)(6) of this section as follows:

(1) The outlet sampling site shall be the same as for the particulate matter measurement. The inlet site shall be selected according to Method 1, or as specified by the Administrator.

(2) Randomly select 9 sampling points within the cross-section at both the inlet and outlet sampling sites. Use the first set of three for the first run, the second set for the second run, and the third set for the third run.

(3) Simultaneously with each particulate matter run, extract and analyze for CO_2 an integrated gas sample according to Method 3, traversing the three sample points and sampling at each point for equal increments of time. Conduct the runs at both inlet and outlet sampling sites.

(4) Measure the volumetric flow rate at the inlet during each particulate matter run according to Method 2, using the full number of traverse points. For the inlet make two full velocity traverses approximately one hour apart during each run and average the results. The outlet volumetric flow rate may be determined from the particulate matter run (Method 5).

(5) Calculate the adjusted CO_2 percentage using the following equation:

$$(\%\ CO_2)_{adj} = (\%\ CO_2)_{di}\ (Q_{di}/Q_{do})$$

where:

$(\%\ CO_2)_{adj}$ is the adjusted CO_2 percentage which removes the effect of CO_2 absorption and dilution air,
$(\%\ CO_2)_{di}$ is the percentage of CO_2 measured before the scrubber, dry basis,
Q_{di} is the volumetric flow rate before the scrubber, average of two runs, dscf/min (using Method 2), and
Q_{do} is the volumetric flow rate after the scrubber, dscf/min (using Methods 2 and 5).

(6) Alternatively, the following procedures may be substituted for the procedures under paragraphs (c) (3), (4), and (5) of this section:

(i) Simultaneously with each particulate matter run, extract and analyze for CO_2, O_2, and N_2 an integrated gas sample according to Method 3, traversing the three sample points and sampling for

Note Fyrite analysis taken 4/29/93
before scrubber 9.0% CO_2

equal increments of time at each point. Conduct the runs at both the inlet and outlet sampling sites.

(ii) After completing the analysis of the gas sample, calculate the percentage of excess air (% EA) for both the inlet and outlet sampling sites using equation 3–1 in Appendix A to this part.

(iii) Calculate the adjusted CO_2 percentage using the following equation:

$$(\% CO_2)_{adj} = (\% CO_2)_{di} \left[\frac{100 + (\% EA)_i}{100 + (\% EA)_o}\right]$$

where:

$(\% CO_2)_{adj}$ is tho adjusted outlet CO_2 percentage,

$(\% CO_2)_{di}$ is the percentage of CO_2 measured before the scrubber, dry basis,

$(\% EA)_i$ is the percentage of excess air at the inlet, and

$(\% EA)_o$ is the percentage of excess air at the outlet.

(d) Particulate matter emissions, expressed in g/dscm, shall be corrected to 12 percent CO_2 by using the following formula:

$$c_{12} = \frac{12c}{\% CO_2}$$

where:

c_{12} is the concentration of particulate matter corrected to 12 percent CO_2,

c is the concentration of particulate matter as measured by Method 5, and

$\% CO_2$ is the percentage of CO_2 as measured by Method 3, or when applicable, the adjusted outlet CO_2 percentage as determined by paragraph (c) of this section.

[39 FR 20790, June 14, 1974]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 7414).)

Subpart F—Standards of Performance for Portland Cement Plants

§ 60.60 Applicability and designation of affected facility.

[42 FR 37936, July 25, 1977]

(a) The provisions of this subpart are applicable to the following affected facilities in portland cement plants: kiln, clinker cooler, raw mill system, finish mill system, raw mill dryer, raw material storage, clinker storage, finished product storage, conveyor transfer points, bagging and bulk loading and unloading systems.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

§ 60.61 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Portland cement plant" means any facility manufacturing portland cement by either the wet or dry process.

§ 60.62 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any kiln any gases which:

(1) Contain particulate matter in excess of 0.15 kg per metric ton of feed (dry basis) to the kiln (0.30 lb per ton).

(2) Exhibit greater than 20 percent opacity.

[39 FR 39872, November 12, 1974]

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any clinker cooler any gases which:

(1) Contain particulate matter in excess of 0.050 kg per metric ton of feed (dry basis) to the kiln (0.10 lb per ton).

(2) Exhibit 10 percent opacity, or greater.

(c) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility other than the kiln and clinker cooler any gases which exhibit 10 percent opacity, or greater.

(d) [Deleted].

[39 FR 20790, June 14, 1974; 40 FR 36250, October 6, 1975]

§ 60.63 Monitoring of operations.

(a) The owner or operator of any portland cement plant subject to the provisions of this part shall record the daily production rates and kiln feed rates.

[39 FR 20790, June 14, 1974]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 7414).)

§ 60.64 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.62 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis.

(b) For Method 5, the minimum sampling time and minimum sample volume for each run, except when process variables or other factors justify otherwise to the satisfaction of the Administrator, shall be as follows:

(1) 60 minutes and 0.85 dscm (30.0 dscf) for the kiln.

(2) 60 minutes and 1.15 dscm (40.6 dscf) for the clinker cooler.

(c) Total kiln feed rate (except fuels), expressed in metric tons per hour on a dry basis, shall be determined during each testing period by suitable methods; and shall be confirmed by a material balance over the production system.

(d) For each run, particulate matter emissions, expressed in g/metric ton of kiln feed, shall be determined by dividing the emission rate in g/hr by the kiln feed rate. The emission rate shall be determined by the equation, $g/hr = Q_s \times c$, where Q_s = volumetric flow rate of the total effluent in dscm/hr as determined in accordance with paragraph (a)(3) of this section, and c = particulate concentration in g/dscm as determined in accordance with paragraph (a)(1) of this section.

[39 FR 20790, June 14, 1974]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 7414).)

Subpart G—Standards of Performance for Nitric Acid Plants

§ 60.70 Applicability and designation of affected facility.

[42 FR 37936, July 25, 1977]

(a) The provisions of this subpart are applicable to each nitric acid production unit, which is the affected facility.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

§ 60.71 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Nitric acid production unit" means any facility producing weak nitric acid by either the pressure or atmospheric pressure process.

(b) "Weak nitric acid" means acid which is 30 to 70 percent in strength.

§ 60.72 Standard for nitrogen oxides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which:

6

ANCHORAGE WATER & SEWER UTILITIES

3000 Arctic Boulevard
Anchorage, Alaska 99503
(907) 277-7622

Tony Knowles
Mayor

Owned by the Municipality
of Anchorage

May 7, 1984

Alaska Department of Environmental Conservation
417 E. Street
Anchorage, AK 99501

Attention: Mr. Bill McClarence

Reference: Pt. Woronzof Wastewater Treatment Facility. Incinerator Stack Emmissions Report AAPCA-0580/ACC-517 Permits.

Dear Mr. McClarence:

Listed below is information required semi-annually by the referenced permits. Attached is the stack analysis report required annually. This reporting period covers October 1983 through March 1984.

1. Days Operated:

1983	Oct.	Nov.	Dec.	1984	Jan.	Feb.	Mar.
	27.0	26.2	27.5		6.0*	0*	26.9

2. Average Hourly Charging Rate (Dry lbs per hour)

1983	Oct.	Nov.	Dec.	1984	Jan.	Feb.	Mar.
	1428	1322	1067		687*	NA*	NA**

3. Fuel Consumed (x 100 ft^3 Natural Gas)

1983	Oct.	Nov.	Dec.	1984	Jan.	Feb.	Mar.
	14409	13939	16930		3517*	NA*	8298

4. Opacity: Problems with both the old and new opacity instruments have persisted for the entire reporting period. Therefore, the information required by both permits regarding this parameter is unavailable.

* The sludge incinerator was down for three weeks in January and the entire month of February for a major overhaul.

** This figure is unavailable for March due to sampling and metering failures.

The next emmissions report will be submitted in October of this year. If any questions arise concerning this report I can be reached at telephone number 338-3870.

Sincerely,

RICHARD E. HUTSON
Manager
Treatment Division
AWWU

ANCHORAGE WATER & SEWER UTILITIES

3000 Arctic Boulevard
Anchorage, Alaska 99503
(907) 277-7622

Tony Knowles
Mayor

Owned by the Municipality
of Anchorage

May 7, 1984

Department of Health & Environmental Protection
825 L. Street
Anchorage, AK 99504

Attention: Mr. Robert L. Rasmussen
Anchorage Air Pollution Control Agency

Reference: Pt. Woronzof Wastewater Treatment Facility. Incinerator Stack Emmissions Report AAPCA-0580/ACC-517 Permits.

Dear Mr. Rasmussen:

Listed below is information required semi-annually by the referenced permits. Attached is the stack analysis report required annually. This reporting period covers October 1983 through March 1984.

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	27.0	26.2	27.5		6.0*	0*	26.9

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3. Fuel Consumed (x 100 ft^3 Natural Gas)

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The next emmissions report will be submitted in October of this year. If any questions arise concerning this report I can be reached at telephone number 338-3870.

Sincerely,

RICHARD E. HUTSON
Manager
Treatment Division
AWWU

ATMOSPHERIC
EMISSION
EVALUATION

ANCHORAGE WATER & WASTEWATER UTILITY
SEWAGE SLUDGE INCINERATOR

APRIL 1984

ASA CONSULTANTS
15049 Bel-Red Road, Bellevue, WA 98007 (206)641-5130

CONSULTANTS
AIR, WATER, ENERGY, HYGIENE & MANAGEMENT

April 27, 1984

INTRODUCTION

This atmospheric emission evaluation was performed at the Sewage Sludge Incinerator at the Point Woronzof Wastewater Treatment Plant which is owned and operated by the Municipality of Anchorage, Water and Wastewater Utility (AW&WWU). The tests were collected on April 13, 1984 to assess the atmospheric emissions for comparison to the State of Alaska, Department of Environmental Conservation (ADEC) regulations. The emission tests were observed and visible emissons were recorded by Mr. Bill MacClarence of ADEC. Mr. Wesley D. Snowden of ASA CONSULTANTS (ASA) performed this evaluation.

SUMMARY

?

Atmospheric emissions were found to be 0.013, 0.015 and 0.014 grains per standard cubic foot of exhaust gas from three (3) samples while incinerating 1294, 1159 and 1193 pounds of dry solids per hour containing 28% moisture plus 18 gallons/hour of "scum" for Run Nos. 1, 2 & 3 respectively. The scrubber was operating at 11.0 inches water column pressure drop while utilizing 280 gallons of plant effluent water per minute for particulate removal. The standard cubic foot of exhaust gas is reported at 68 degrees F, 1.0 atmosphere pressure (i.e. 29.92 inches of mercury pressure), dry and corrected to 12% carbon dioxide less the contribution of carbon dioxide from the combustion of natural gas.

ASA CONSULTANTS

Wesley D. Snowden, P.E.

15046 Bel-Red Road, Suite 100 Bellevue, Washington 98007 (206)641-5190

DISCUSSION

The incinerator at the Point Woronzof Treatment Plant of the Anchorage Water and Wastewater Utility is a continuous feed, continuous ash removal incinerator. The incinerator is identifed as Furnace No. 71343 built by BSP-Envirotech in Belmont, California. A log of incinerator operation was maintained during the times the samples were collected and is available from J. Kris Warren of the Anchorage Water & Wastewater Utility (907)243-2151.

Over five (5.68) diameters were available ahead and more than two (2) diameters of straight unobstructed duct were available behind the two (2) sample ports at 90 degrees apart so sixteen (16) traverse points on each of two (2) diameters were selected for collecting the first sample. The first sample revealed a uniform velocity and resulted in collecting over 80 cubic feet of sample requiring 96 minutes to complete using three (3) minutes per sample traverse point. Samples two and three were collected with the same three (3) minutes per sample traverse point however the sample points were reduced to ten (10) per traverse for a sixty (60) minute sample period. Sample one was collected over the first half of the test assuming a fifteen percent (15%) moisture in the stack which accounts why the nozzle velocity was less than the desired minimum of 90%. Corrections were made for nonisokinetic nozzle velocities in the report. The first and second samples were collected assuming the nozzle diameter was 0.25 inches which upon checking after the second sample was found to be 0.265 inches. The assumed less than actual nozzle diameter accounts for the less than desirable nozzle velocity on Run #1 and why the Run #2 nozzle velocity was less than Run #3.

The particulate on this project consisted of the nozzle and probe catches (i.e. the "front-half" of the US Environmental Protection Agency (EPA) Method 5 sampling train). The probe was cleaned with reagent grade acetone and brushes and analyzed per the procedures in the Clean-up & Analysis section of this report. The condenser portion of Run #1 was inspected by Mr. MacClarence of ADEC to determine if hydrocarbon was present. No hydrocarbon was detected by sight or smell so the condenser portion of the sample was not analyzed for hydrocarbon.

The particulate emission samples collected on this project were reported on the basis of concentration corrected to 12% carbon dioxide less the contribution of carbon dioxide from the auxilary fuel. The procedures in performing this emission sample project were specified by the Alaska Department of Environmental Conservation (ADEC).

Orsat grab samples were collected before, at the middle of the traverse and at the end of each sample. At least two samples with carbon dioxide concentrations agreeing within 0.5% were collected before the complete Orsat analysis was performed. The gas sample pump collected a gas sample from a tap at the outlet of the EPA Method 5 sample train, pumped the gas into the Orsat analyzer and then utilized the excess gas from the Orsat to collect a gas sample on each run. An inflatable bag was utilized to collect the gas not being used by the Orsat analyzer which constituted an integrated gas sample. The integrated bag gas sample was analyzed immediately after the sample and recorded on the field data sheet. The integrated bag sample was utilized to report the carbon dioxide, oxygen and carbon monoxide concentrations during the times of the samples. The gas sample line was checked frequently for leaks by pinching the flexible hose connected to the Method 5 sample train outlet tap and the pump and was considered leak tight if the stack gas bubbling through the leveling bulb of the Orsat stopped after a short period of time (e.g. 30 seconds).

The quantity of auxiliary fuel burned during the day of sampling was 24,500 cubic feet or 17 cubic feet per minute. One cubic foot of natural gas produces one cubic foot of carbon dioxide in the combustion process. The percent carbon dioxide procduced in the stack which consists of an average of 5012 dscfm from burning the auxiliary fuel is therefore 0.34% carbon dioxide which was subtracted from the measured carbon dioxide before making the correction to 12% carbon dioxide.

Dilution air (i.e from cooling of the incinerator shaft) was entering the stack at a position just after the incinerator exhaust fan and just below the roof. Oxygen readings were taken at the exhaust fan outlet (i.e. just below the dilution air inlet) and in the exhaust stack where the samples were collected. Knowing that the oxygen concentration of the dilution air is 21%, the total airflow is 5012 dscfm, the average oxygen at the incinerator exhaust fan outlet was 13.65%, the average oxygen concentration at the stack was 15.88% and balancing the oxygen and air with the two equations listed below, the quantity of dilution air was determined.

EQ 1. Incin Air + Dil Air = Stack Air = I + D = 5012 dscfm

EQ 2, Incin O_2 + Dil O_2 = Stack O_2 = (0.1588)(5012) = 795.9

$(I)(0.1365) + (D)(0.21) = 795.9$ with $D = 5012 - I$

Therefore, D = 1521 dscfm

The effect of dilution air on the emissions is accounted for in the correction to 12% carbon dioxide. Therefore the dilution air was not utilized to calculate an adjusted particulate emission concentration.

This report hereafter is arranged in the order in which the data can be most readily used. The report is arranged as follows:

- "EPA Method 5 Summary" (a summary of test results) if used on project.
- "Terminology & Equations" used in calculating the results
- "Procedure" illustrating how samples are typically collected
- "PMR Calculation" illustrates how calculations are performed for non-isokinetics
- "EPA Method 5 Particulate Sampling Train" schematic illustates train parts
- "Clean-up and Analysis" procedures utilized on this project
- "EPA Method 5 Particulates" calculation sheet utilizes field traverse data sheet for input to the computer with one output sheet per Run
- "Particulate Calculation" utilizes laboratory data and calculates total particulate with one sheet per Run and sequentially placed with the above
- "EPA Method 5 Particulates" sheet
- "Orsat Data Calculation Sheet" used for determining dry molecular weight of the exhaust gas if the calculation is not performed by the "EPA Method 5 Particulates" output and sequentially placed with the above two computer output sheets
- Process Operating Log if used for project
- "Traverse Sampling Data Sheet" contains data collected from the field
- "Calibration Records" of the equipment utilized on this project. Spot calibrations are performed before and after the field work. If within 2%, no changes are made in the calibration records.

ASA CONSULTANTS E.P.A. METHOD 5 SUMMARY

CLIENT: ANCHORAGE WATER & WASTEWATER UTILITY PT WORONZOF TREATMENT PLANT

SAMPLING LOCATION: SEWAGE SLUDGE INCINERATOR STACK EMISSIONS - APRIL 1984

	RUN # 1 4/13/84	RUN # 2 4/13/84	RUN # 3 4/13/84
LAB NUMBER	27-4	28-4	29-4
24 HOUR START TIME	930	1335	1559
24 HOUR STOP TIME	1117	1437	1702
ELAPSED SAMPLING TIME, MIN	96.2	60	60
VOLUME SAMPLED, CU FT	81.636	56.192	64.894
VOLUME SAMPLED STANDARD, CU FT	78.9862	53.2465	61.9348
MOISTURE CONTENT OF STACK GAS, %	1.78421	1.75912	1.81087
MOLEC. WT OF STACK GAS, LB/LB MOLE	29.23	29.2223	29.2116
STACK PRESSURE, IN HG	29.6669	29.6869	29.7469
PITOT COEFFICIENT	.822	.822	.822
VELOCITY OF STACK GAS, FT/SEC	49.1617	48.2209	50.4552
STACK AREA, SQR FT	1.96895	1.96895	1.96895
STACK GAS FLOW RATE, ACTUAL CU FT/MIN, WET	5807.81	5696.67	5960.62
TEMPERATURE OF STACK, DEG F	142.313	132.9	138.4
STACK GAS FLOW RATE, STD CU FT/MIN, DRY	4958.11	4945.03	5134.26
DIAMETER OF NOZZLE, INCHES	.265	.265	.265
PERCENT ISOKINETIC OF TEST, %	85.1286	92.2543	103.353
WEIGHT PARTICULATE COLLECTED, MG	32.4	23.3	24.6
PARTICULATE CONCENTRATION, GRAINS/STD CU FT	6.31705E-03	6.73884E-03	6.11676E-03
PERCENT CO2 CONTENT OF STACK GAS	5.32	5.23	5.19
PART. CONC AT 12% CO2, GR/STD CU FT	.014249	.015462	.0141428
POLLUTANT MASS RATE (CONC. METHOD), LB/HR	.268449	.285618	.268172
POLLUTANT MASS RATE (AREA RAT. METHOD), LB/HR	.228539	.263508	.27921
POLLUTANT MASS RATE (AVERAGE OF ABOVE), LB/HR	.248494	.274563	.273691
PARTICULATE CONCENTRATION (CORRECTED)	.0131891	.0148628	.0143795

PARTICULATE CONCENTRATION AND PMR CALCULATION TERMINOLOGY ‡

(Page 1)

VOLM, VOL_m (V_m) = Dry gas meter volume @ meter temperature and pressure, dry-acf

PM, P_m ($P_{bar} + \frac{\Delta H}{13.6}$) = Dry gas meter pressure (recorded as inlet deflection across orifice meter) - "Hg

PBAR (P_{bar}) = Barometric Pressure @ sampling site (inches of Hg)

TM, T_m (T_m) = Dry gas meter temperature (average of inlet and outlet) - ^oF (Use $^oR = 460 + {}^oF$ in equations)

PSTD, P_{STD} (P_{std}) = Standard atmospheric pressure, absolute - (29.92 "Hg)

TSTD, T_{STD} (T_{std}) = Standard temperature, absolute - ^oR

VOLSTD, VOL_{STD} ($V_{m(std)}$) = Standardized gas that passes through the sampling train - cubic feet, 70^oF, 1 atmosphere pressure, and dry

VOLW, VOL_W ($V_{W(std)}$) Volume of water collected (expressed as vapor at standard temperature and pressure) - scf

VOLH2O (V_{1c}) = Volume of H_2O collected (expressed in milliliters)

M, %M (100 B_{ws}) = %water, calculated from amount the train collected in impinger, bubblers, and on silica gel

MF ($1-B_{ws}$) = Mole fraction of dry gas

WD, W_o (M_d) = Molecular weight of dry stack gas - lb/lb mole

WW, W_w (M_s) = Molecular weight of wet stack gas - lb/lb mole

W_a (*) = Molecular weight of air (28.95 lb/lb mole)

CD, C_D (*) = Velocity correction coefficient for gas density at STP

PSN, P_{SN} (P_s) = Stack pressure (static + barometric), absolute - "Hg

CS, C_S (*) = Velocity correction coefficient for stack pressure

VH, VH_n (ΔP) = Individual pitot tube pressure differential readings - inches water

n (*) = Number of velocity head readings

VO, V_o (V_s) = Stack velocity @ stack conditions - fps

QO, Q_o (*) = Stack flow rate at stack conditions - acfm

TS, T_s ($T_{s(ave)}$) = Average stack temperature, absolute - ^oF (Use $^oR = 460 + {}^oF$ in equations)

DELTA H (ΔH) = Deflection on orifice flow meter when sample air flows through meter box (inches of water)

PARTICULATE CONCENTRATION AND PMR CALCULATION TERMINOLOGY

(Page 2)

Y (Y) = Dry gas meter calibration factor

Qs, Q_{os} (Q_{SD}) = Stack flow rate at standard conditions - scfm (dry)

T (θ) = Time over which sample was collected - minutes

VN, V_n ($V_{S(std)}$) = Velocity of gases inside nozzle during sampling, at STP -fps

I (I) = % Isokinetic (± 10% desirable)

CO, C_o (C_S) = Particulate concentration - grains/scf

N (%CO_2) = %CO_2 by volume in stack (12 indicates no % CO_2 correction is to be made

TS, T_s (T_{si}) = Temperature of stack gas at each sampling point - °F (Use °R = 460 + °F in equations)

C (*) = Particulate concentration corrected to 12% CO_2

PMRC, PMR_c (*) = Pollutant mass rate - "concentration method" - lb/hr

PMRR, PMR_r (*) = Pollutant mass rate - "area ratio method" - lb/hr

PMRAVG, $\overline{PMR}$ (*) = Average pollutant mass rate - lb/hr

CPRIME, C' (*) = Particulate concentration corrected for non-isokinetic sampling condition - grains/scf

PT, P_T (M_n) = Total particulate collected by sampling train - mg

A1, A2, A_s (A) = Area of stack - FT^2 A2 = 0 if round stack

A_n (A_n) = Area of nozzle - FT^2

DN (*) = Diameter of nozzle in IN^2

CP, C_p (C_p) = Velocity correction coefficient for type pitot tube used - dimensionless, normally 0.80 to 0.90 for "S" type pitot tube and 1.0 for "P" type pitot tube

KA, K_a (*) = Average $\sqrt{VH \times T_s}$

‡Notation in parenthesis to the right of the ASA nomenclature is the equivalent EPA 40 CFR 60 Method 5 notation

* Notation used by ASA for calculations not required by 40 CFR 60 Method 5

PARTICULATE CONCENTRATION AND PMR CALCULATION EQUATIONS

1. $VOL_{STD} = \dfrac{(Y)(VOL_m)(P_m)(T_{STD})}{(P_{STD})(T_m)}$

2. $\%M = \dfrac{(100)(VOL_w)}{VOL_{STD} + VOL_w}$

3. $MF = \dfrac{100 - M}{100}$

4. $W_w = (W_d)(MF) + 18\ (1-MF)$

5. $C_D = \sqrt{W_a/W_w}$

6. $C_S = \sqrt{P_{STD}/P_{SN}}$

7. $K_a = \sum \sqrt{(VH_n \times T_{S_n})}/n$

*8. $V_o = 2.9\ (K_a)(C_p)(C_D)(C_S)$

9. $Q_o = (V_o)(A_S)(60)$

10. $Q_{Os} = \dfrac{(Q_o)(T_{STD})(P_{SN})(M_F)}{(T_S)(P_{STD})}$

11. $V_n = \dfrac{(VOL_{STD})(P_{STD})(T_S)}{(M_F)(T_{STD})(P_{SN})(T)(A_N)(60)}$

12. $I = (100)\ V_n/V_o$

*13. $C_o = (0.0154)\ P_T/VOL_{STD}$

14. $C = \dfrac{(C_o)(12)}{N}$

*15. $PMR_c = (C_o)(Q_s)(0.008571)$

*16. $PMR_r = \dfrac{(P_T)(A_s)}{(T)(A_n)}(0.000132)$

*17. $\overline{PMR} = (PMR_c + PMR_r)/2$

*18. $C' = (\overline{PMR})(1400)/Q_{os}N$

* UNITS FOR THE CONSTANTS USED ARE GIVEN BELOW:

8. $2.9\ \left(\frac{FT}{SEC}\right)(\text{INCHES OF } H_2O \times {}^{o}R)^{-1/2}$ based on Bernoulli's equation at STP and a molecular weight of dry gas of 28.95 and english units.

13. $.0154\ \text{grain/mg} = \left(\frac{mg}{ft^3}\right)\left(\frac{7000\ grains}{lb}\right)\left(\frac{lb}{453.6g}\right)\left(\frac{g}{1000mg}\right)$

15. $.008571\ \left(\frac{min\text{-}lbs}{hr\text{-}grains}\right) = \left(\frac{grains}{ft^3}\right)\left(\frac{ft^3}{min}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{lbs}{7000\ grains}\right)$

16. $.000132\ \left(\frac{lb\text{-}min}{mg\text{-}hr}\right) = \left(\frac{mg}{min}\right)\left(\frac{ft^2}{ft^2}\right)\left(\frac{g}{1000mg}\right)\left(\frac{lb}{453.6g}\right)\left(\frac{60\ min}{hr}\right)$

18. $1400\ \left(\frac{hr\text{-}grains}{min\text{-}lb}\right) = \left(\frac{lb}{hr}\right)\left(\frac{min}{ft^3}\right)\left(\frac{12}{n}\right)\left(\frac{hr}{60\ min}\right)\left(\frac{7000\ grains}{lb}\right)$

PROCEDURE

EPA METHOD 5 PARTICULATE SAMPLING TRAIN

Sampling Train Preparation:

A tared and labeled glass fiber filter was placed in a glass filter holder. The filter (MSA1106BH) was desiccated and weighed to a constant weight to the nearest 0.5 mg. The condenser section consisted of four glass containers in series: one hundred milliliters of distilled-deionized water in a bubbler; one hundred milliliters in an impinger; a dry bubbler; and, a bubbler filled with approximately 500 grams of silica gel. All of the containers were weighed to the nearest 0.1 gram. The sampling train was assembled with connecting glassware so that sample gas would pass through the filter, the bubbler, impinger, the dry bubbler and the silica gel respectively.

A nozzle of a size that would allow for isokinetic sampling was selected and cleaned. A probe and liner of appropriate length to traverse the stack was chosen and the liner cleaned with acetone and a brush. The nozzle was connected with a cleaned union to the probe and liner. The probe was connected in front of the filter. A schematic of the sampling equipment is included in this report.

A leak test was performed on the assembled sampling train. The leak rate did not exceed 0.02 cfm at a vacuum of 10 inches Hg. The probe was heated and maintained at or above 250 degrees plus or minus 25 degrees F. The filter was heated and maintained at 250 degrees plus or minus 25 degrees F to avoid condensation of moisture on the filter. Crushed ice was placed around the condenser at the beginning of the test with new ice being added as required to keep the gases leaving the sampling train below 70 degrees F.

Sample Collection:

Sampling ports were selected and installed. The number of sampling points was determined based on the number of stack diameters from any flow disturbance to the port(s). The location of each sampling point was based on equal areas within the stack.

The time at each point was dependent on the stack velocity and the desired volume to be sampled.

The probe was inserted into the stack to the first traverse point with the nozzle tip pointing directly into the gas stream. The pump was started and immediately adjusted to sample at isokinetic velocities. Equal time was spent at each time interval. The EPA designed nomograph or equivalent was used to maintain isokinetic sampling throughout the sampling period. At the conclusion of the run the pump was turned off, and a final leak test was performed at the maximum vacuum incurred during sampling. If the post-test leak rate was found to be over 0.02 cfm the actual leak rate was recorded.

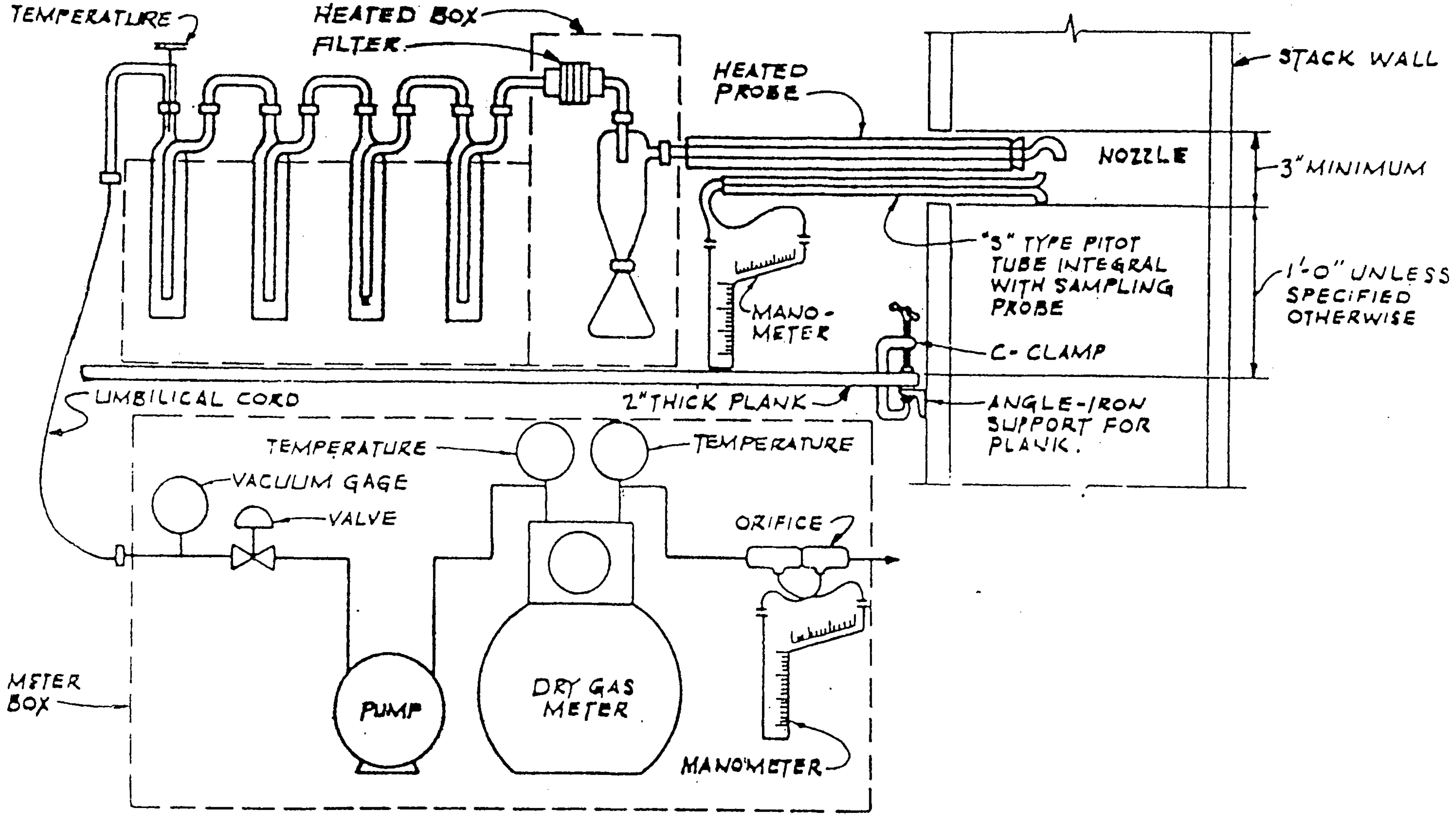

FIGURE 1.

EPA METHOD 5 PARTICULATE SAMPLING TRAIN

DRAWN RSC
CHECKED WS
DATE 9/30/74

CONSULTANTS
Bellevue, WA

PMR CALCULATIONS

The weight of the dust per volume and weight of dust per time were calculated using two procedures:

1) The Concentration Method

The concentration of dust entering the sampling nozzle is calculated and then multiplied by the volumetric flow rate of the stack gases to obtain the pollutant mass rate on a concentration basis (PMR_c).

Concentration in Nozzle x Volumetric Flow Rate =
Pollutant Mass Rate On Concentration Basis

$$(P_T/VOL_{STD}) \times Q_s = PMR_c$$

Assuming the nozzle velocity is greater than the average stack gas velocity (V_n greater than V_o), the calculated pollutant mass rate will be less than the true pollutant mass rate because the heavier dust particles will leave their velocity streamline and not enter the nozzle. If V_n is less than V_o then the calculated PMR_c will be greater than the true PMR.

2) The Area Ratio Method

The weight of dust collected is divided by the sampling time and multiplied by the ratio of the stack area to the nozzle area to obtain the calculated pollutant mass rate based on the area ratio method (PMR_r).

$$\frac{\text{Weight Collected}}{\text{Sample Time}} \times \frac{\text{Area of Stack}}{\text{Area of Nozzle}} = \begin{array}{l}\text{Pollutant Mass Rate}\\ \text{on Area Ratio Basis}\end{array}$$

$$(P_T/T) \times A_s/A_n = PMR_r$$

Assuming the nozzle velocity is greater than the average stack gas velocity (V_n greater than V_o), the calculated pollutant mass rate will be greater than the true pollutant mass rate because the lighter particles in the dust laden stream follow their streamlines and enter the sampling nozzle resulting in P_T/T being greater than true. If V_n is less than V_o, the calculated PMR_r will be less than the true PMR.

To obtain a more true pollutant mass rate, the two calculated pollutant mass rates are averaged. This allows some of the bias introduced because of non-isokinetic sampling calculated by one method to offset the bias of the other method. The degree of bias is related to particle size and density.

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ASA CONSULTANTS                              E.P.A. METHOD 5 - PARTICULATES

JOB NAME:  ANCHORAGE WATER & WASTEWATER UTILITY WORONZOF TREATMENT PLANT

PREPARED BY:  W. D. SNOWDEN                  DATE:  4/13/84

SUBJECT:  SEWAGE SLUDGE INCINERATOR STACK EMISSIONS - RUN #1

********************************************************

VOLM = 81.636   PBAR = 29.7   DELTA H = 2.27   TM = 84.2   LAB NUMBER = 27-4

PM = 29.8669  VOL(STD) = 78.9862  VOLH2O = 30.4  Y= .999

CO2 =  5.66 CO2 + O2 = 18.87 CO2 + O2 + CO = 18.87 O2 = 13.21 CO = 0

VOLW = 1.43488   WD = 29.434   PS =-.45   PSN = 29.6669   CP = .822

M = 1.78421  MF = .982158  WW = 29.23  CD = .995199  CS = 1.00426

A1 = 19  A2 = 0  AS = 1.96895  T = 96.2  DN = .265  PT = 32.4  N = 5.32


OBS     VH     TS      KA                 OBS     VH     TS      KA

1       .45    141     16.4454            2       .45    141     16.4454
3       .54    143     18.0449            4       .6     145     19.0526
5       .6     146     19.0683            6       .64    146     19.6937
7       .69    142     20.3809            8       .72    149     20.9399
9       .72    142     20.8192            10      .81    133     21.9164
11      .85    125     22.2991            12      .88    120     22.592
13      .88    117     22.5335            14      .88    113     22.4553
15      .85    115     22.1077            16      .85    116     22.1269
17      .4     185     16.0624            18      .4     195     16.1864
19      .48    194     17.7178            20      .5     194     18.0831
21      .57    193     19.2927            22      .65    190     20.5548
23      .7     181     21.1825            24      .82    146     22.2917
25      .87    133     22.7136            26      .88    130     22.786
27      .92    124     23.1793            28      .92    118     23.0599
29      .92    115     23                 30      .9     110     22.6495
31      .88    106     22.3177            32      .88    106     22.3177

******************************************************

START TIME = 930   STOP TIME = 1117   FILE = 274

KA = 20.6349  TS = 142.313  VO = 49.1617  QO = 5807.81  QS = 4958.11

VN = 41.8506   I = 85.1286   CO = 6.31705E-03   C = .014249

PMRC = .268449  PMRR = .228539  PMRAVG = .248494  C' = .0131891
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ASA CONSULTANTS PARTICULATE CALCULATION

CLIENT: ANCHORAGE WATER & WASTEWATER UTILITY WORONZOF TREATMENT PLANT

LOCATION: SEWAGE SLUDGE INCINERATOR STACK EMISSIONS

SAMPLE DATE: 4/13/84 ANALYSIS DATE: 4/16-24/84

RUN # 1 LAB # 27-4

****

I. EVAPORATION OF 75 ml OF ACETONE RINSE AND (B)
BRUSHING OF NOZZLE, PROBE AND GLASSWARE BEFORE FILTER.

FINAL 79723.7 mg - TARE 79721.5 mg
- BLANK ((5E-03 mg/ml) (75 ml) = .375 mg) = 1.825 mg

II. FILTER CATCH - FILTER MSA1106BH - NUMBER 9-4 (A)

FINAL 424.5 mg - TARE 393.9 mg = 30.6 mg

VII. TOTAL PARTICULATE = SUM OF ABOVE = 32.425 mg

BLANKS

ACETONE (FINAL 80883.9 mg - TARE 80883.4 mg = .5 mg)
/ 100 ml = 5E-03 mg/ml

CLIENT: ANCHORAGE WATER & WASTEWATER UTILITY TREATMENT PLANT

LOCATION: SEWAGE SLUDGE INCINERATOR STACK EMISSIONS

SAMPLE DATE: 4/13/84 ANALYSIS DATE: 4/16-24/84

RUN # 2 LAB # 28-4

****

I. EVAPORATION OF 95 ml OF ACETONE RINSE AND (B)
BRUSHING OF NOZZLE, PROBE AND GLASSWARE BEFORE FILTER.

FINAL 77867.4 mg - TARE 77861.3 mg
- BLANK ((5E-03 mg/ml) (95 ml) = .475 mg) = 5.625 mg

II. FILTER CATCH - FILTER MSA1106BH - NUMBER 7-4 (A)

FINAL 406.1 mg - TARE 388.4 mg = 17.7 mg

VII. TOTAL PARTICULATE = SUM OF ABOVE = 23.325 mg

BLANKS

ACETONE (FINAL 80883.9 mg - TARE 80883.4 mg = .5 mg)
/ 100 ml = 5E-03 mg/ml

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ASA CONSULTANTS                                 E.P.A. METHOD 5 - PARTICULATES

JOB NAME:  ANCHORAGE WATER & WASTEWATER UTILITY WORONZOF TREATMENT PLANT

PREPARED BY:  W. D. SNOWDEN                      DATE:  4/13/84

SUBJECT:  SEWAGE SLUDGE INCINERATOR STACK EMISSIONS - RUN #2

****************************************************

VOLM = 56.192   PBAR = 29.72   DELTA H = 2.61   TM = 96.5   LAB NUMBER = 28-4

PM = 29.9119  VOL(STD) = 53.2465  VOLH2O = 20.2  Y= .999

CO2 =  5.57 CO2 + O2 = 18.87 CO2 + O2 + CO = 18.9 O2 = 13.3 CO = .0300007

VOLW = .95344   WD = 29.4232   PS =-.45   PSN = 29.6869   CP = .822

M = 1.75912  MF = .982409  WW = 29.2223  CD = .995331  CS = 1.00392

A1 = 19  A2 = 0  AS = 1.96895  T = 60  DN = .265  PT = 23.3  N = 5.23

OBS      VH      TS         KA                  OBS      VH      TS        KA

1        .45     184       17.0235               2       .45     178      16.944
3        .47     174       17.2621               4       .54     160      18.2975
5        .64     132       19.4648               6       .83     122      21.9786
7        .9      118       22.8079               8       .91     116      22.8945
9        .91     110       22.775               10       .9      110      22.6495
11       .52     137       17.6193              12       .57     138      18.4624
13       .58     139       18.6392              14       .67     139      20.0332
15       .73     132       20.7885              16       .77     120      21.1329
17       .81     120       21.6749              18       .85     113      22.0692
19       .79     108       21.183               20       .79     108      21.183

****************************************************

START TIME = 1335   STOP TIME = 1437   FILE = 284

KA = 20.2442  TS = 132.9  VO = 48.2209  QO = 5696.67  QS = 4945.03

VN = 44.4859   I = 92.2543   CO = 6.73884E-03   C = .015462

PMRC = .285618  PMRR = .263508  PMRAVG = .274563  C' = .0148628
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ASA CONSULTANTS                               E.P.A. METHOD 5 - PARTICULATES

JOB NAME:  ANCHORAGE WATER & WASTEWATER UTILITY WORONZOF TREATMENT PLANT

PREPARED BY:  W. D. SNOWDEN                   DATE:  4/13/84

SUBJECT:  SEWAGE SLUDGE INCINERATOR STACK EMISSIONS - RUN #3

*******************************************************

VOLM = 64.894   PBAR = 29.78   DELTA H = 3.69   TM = 95.1   LAB NUMBER = 29-4

PM = 30.0513  VOL(STD) = 61.9348  VOLH2O = 24.2  Y= .999

CO2 =  5.53 CO2 + O2 = 18.87 CO2 + O2 + CO = 18.87 O2 = 13.34 CO = 0

VOLW = 1.14224   WD = 29.4184   PS =-.45   PSN = 29.7469   CP = .822

M = 1.81087  MF = .981891  WW = 29.2116  CD = .995512  CS = 1.00291

A1 = 19  A2 = 0  AS = 1.96895  T = 60  DN = .265  PT = 24.6  N = 5.19


OBS      VH      TS          KA                   OBS      VH      TS          KA

1        .49     145      17.2177                 2        .55     145      18.2414
3        .63     146      19.5392                 4        .69     155      20.5998
5        .69     150      20.5159                 6        .81     139      22.027
7        .87     130      22.6561                 8        .91     118      22.9343
9        .91     113      22.8348                 10       .87     108      22.2297
11       .44     190      16.9115                 12       .48     198      17.7719
13       .62     186      20.013                  14       .7      179      21.1495
15       .91     132      23.2103                 16       .96     118      23.5559
17       .96     108      23.3512                 18       .96     104      23.2689
19       .96     102      23.2276                 20       .92     102      22.7385

*******************************************************

START TIME = 1559   STOP TIME = 1702   FILE = 294

KA = 21.1997  TS = 138.4  VO = 50.4552  QO = 5960.62  QS = 5134.26

VN = 52.1468   I = 103.353   CO = 6.11676E-03   C = .0141428

PMRC = .269172  PMRR = .27821  PMRAVG = .273691  C' = .0143795
```

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ASA CONSULTANTS                                    PARTICULATE CALCULATION

CLIENT: ANCHORAGE WATER & WASTEWATER UTILITY TREATMENT PLANT

LOCATION: SEWAGE SLUDGE INCINERATOR STACK EMISSIONS

SAMPLE DATE: 4/13/84                               ANALYSIS DATE: 4/16-24/84

RUN # 3                                            LAB # 29-4

*****************************************************

I.   EVAPORATION OF  130 ml OF ACETONE RINSE AND (B)
     BRUSHING OF NOZZLE, PROBE AND GLASSWARE BEFORE FILTER.

     FINAL  80699.75 mg - TARE  80699.10000000001 mg
     - BLANK (( 5E-03 mg/ml) ( 130 ml) =  .65 mg)         = 2.38397E-08 mg

II.   FILTER CATCH - FILTER MSA1106BH - NUMBER 11-4 (A)

      FINAL  419.4 mg - TARE  394.8 mg                   = 24.6 mg

VII.  TOTAL PARTICULATE = SUM OF ABOVE                   = 24.6 mg
----  ----- ----------- - --- -- -----                    ----------


     BLANKS
     ------

     ACETONE (FINAL 80883.9 mg - TARE 80883.4 mg =  .5 mg)
           /  100 ml =  5E-03 mg/ml
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APPENDIX

CLIENT Anch W&WW Utility DATE 9/13/84 2/2
PORT LOCATION Sludge Incinerator Outlet Stack
RUN NO. 1 LAB NO. 27-4
OPERATOR/S SNOWDEN
SAMPLE BOX NO. BLACK METER BOX ΔH@ ______
FILTER NO ______ TARE ______ Mg ______

ASA CONSULTANTS

TRAVERSE SAMPLING DATA SHEET

DISTANCE UPSTREAM & DOWNSTREAM FROM OBSTRUCTION ______ & ______

INTEGRATED BAG
5,6 5,7 5,7
18,8 18,9 18,9
18,8 18,9 18,9

BOX AND PROBE HEATER SETTING ______
BAROMETRIC PRESSURE (P_B) ______ "Hg
LEAK RATE ______ CFM @ ______ "Hg
PORT PRESSURE (P_S) ______ "H_2O = ______ "Hg
P_{SN} = P_B + P_S ______ "Hg
ASSUMED MOISTURE ______ % MAX VH ______ "H_2O
C FACTOR ______
REF. ΔP ______
STACK DIMENSIONS 19" I.D. AREA ______ F^2
PROBE NOZZLE DIA. ______ IN; A_N ______ F^2
PROBE LENGTH 16" NUMBER 26 SIDE 2

	FINAL WT. gm	INITIAL WT. gm		NET WT. gm
#1 BUBBLER			=	
#2 IMPINGER			=	
#3 BUBBLER			=	
#4 SILICA GEL			=	

TOTAL WATER VOLUME (1gm = 1 ml) ______

SCHEMATIC OF TRAVERSE POINT LAYOUT

Cp = 0,822

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES READ WITHIN THE TIME INTERVAL						
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F)		BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O)		PUMP VACUUM ("Hg GA.)	STACK TEMP. (°F)	OPACITY OR %CO_2
			INLET	OUTLET					DESIRED	ACTUAL			
					243	52							
1055	75	75,50	120	94	253	53	N 9	0,87	3,3	3,3	5,0	133	
	78	78,20	121	95	247	53	10	0,88	3,4	3,4	5,0	130	
	81	81,47	122	96	243	54	11	0,92	3,45	3,45	5,5	124	
	84	84,75	123	97	240	54	12	0,92	3,45	3,45	5,5	118	
	87	88,10	125	98	240	54	13	0,92	3,45	3,45	5,5	115	
	90	89,90	126	99	238	55	14	0,90	3,40	3,40	5,5	110	
	93	94,60	126	100	235	56	15	0,88	3,4	3,40	5,5	106	
1117	96,2	98,113	127	101	230	56	N-~~16~~15	0,88	3,4	3,4	5,5	106	
TOTAL	96,2	81,636	3007	2550						72,7 "H_2O			
AVERAGE			84,2 °F = °R						2,27 "H_2O = "Hg			°R	

P_m = P_B + ΔH = "Hg

30

CLIENT Anch W&WW Utility DATE 4/13/84 1/2

ASA CONSULTANTS

TRAVERSE SAMPLING DATA SHEET

PORT LOCATION Sludge Incinerator Stack
RUN NO. 1 LAB NO. 27-4
OPERATOR/S SNOWDEN
SAMPLE BOX NO. BLACK METER BOX ΔH@ 1.82
FILTER NO. 9-4 TARE ____ Mg

	FINAL WT. gm	INITIAL WT. gm	NET WT. gm
#1 BUBBLER	428.5	431.7 =	-3.2
#2 IMPINGER	435.1	425.1 =	10.0
#3 BUBBLER	352.5	349.2 =	3.3
#4 SILICA GEL	720.7	700.4 =	20.3
TOTAL WATER VOLUME (1gm = 1 ml)			30.4

DISTANCE UPSTREAM & DOWNSTREAM FROM OBSTRUCTION ____ & ____

BFR DIL = 13.75 %O2 } [illegible]
AFTER DIL = 16 %O2 }
~~BFR~~ AFTER DIL = 14.75 %O2 } 11:40
BFR DIL 12.5

SCHEMATIC OF TRAVERSE POINT LAYOUT

BOX AND PROBE HEATER SETTING ____ &
BAROMETRIC PRESSURE (P_B) 29.70 "Hg
LEAK RATE 0.005 CFM @ 11 "Hg
PORT PRESSURE (P_S) -.45 "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$ ____ "Hg
ASSUMED MOISTURE ~~10%~~ 20.2 % MAX VH 0.7 "H_2O
C FACTOR 0.73 0.48
REF. ΔP 0.72 0.48
STACK DIMENSIONS 19"Ø AREA ____ F2
PROBE NOZZLE DIA 0.265 IN; A_N ____ F2
PROBE LENGTH 18" NUMBER 28 SIDE 2

Cp = 0.822

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES READ WITHIN THE TIME INTERVAL						
CLOCK TIME (24 HRS)	ELAP TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F)		BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O)		PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2
			INLET	OUTLET					DESIRED	ACTUAL			
930	0	16.477	55	54	244	44	W [illegible]	0.45	1.15	1.15	1.5	141	
	3	18.60	58	54	248	43	2	0.45	1.15	1.15	1.5	141	5.0, 18.8, 18.
	6	19.90	60	54	258	42	3	0.54	1.32	1.32	1.8	143	
	9	21.80	64	55	255	42	4	0.60	1.52	1.52	2.1	145	
	12	24.0	68	55	261	42	5	0.60	1.52	1.52	2.1	146	
	15	26.0	73	56	260	42	6	0.64	1.58	1.58	2.2	146	
	18	28.30	76	57	256	42	7	0.69	1.70	1.70	2.3	142	
	21	30.20	79	59	252	45	8	0.72	1.80	1.80	2.4	149	
	24	32.30	83	66	253	47	9	0.72	1.80	1.80	2.4	142	
	27	34.50	87	62	250	49	10	0.81	2.0	2.00	2.5	133	
	30	37.05	91	64	243	50	11	0.85	2.15	2.15	2.8	125	
	33	38.95	95	67	242	50	12	0.88	2.18	2.18	3.0	120	
	36	40.98	99	69	241	52	13	0.88	2.18	2.18	3.0	117	6.2, 18.2, 18.
	39	44.21	101	74	240	53	14	0.88	2.18	2.18	3.0	113	
	42	46.55	102	75	242	53	15	0.85	2.15	2.15	2.8	115	
	45	49.15	104	76	246	54	W [illegible]	0.85	2.15	2.15	2.8	116	
	48	51.674	105	78	249	54	N 2	0.40	1.50	1.50	2.1	185	
1031	51	53.85	100	83	242	49	2	0.40	1.50	1.50	2.2	195	
34	54	56.60	103	84	240	49	3	0.48	1.85	1.85	2.7	194	4.4, 19.4, 19.4
37	57	58.50	105	86	240	48	4	0.50	1.88	1.88	3.0	194	
40	60	60.70	107	87	239	48	5	0.57	2.10	2.10	3.1	193	
43	63	62.95	109	89	242	49	6	0.65	2.4	2.4	3.9	190	
46	66	66.00	112	90	245	49	7	0.70	2.6	2.6	4.1	181	
49	69	68.80	114	91	247	50	8	0.82	3.1	3.1	4.5	146	
1052	72	71.82	115	91	249	51							
TOTAL			2265	1770						45.46 "H_2O			
AVERAGE			4035 °F = °R						H_2O =	"Hg		°R	

$P_m = P_B + ΔH$ = ____ "Hg

CLIENT Anch. W&WW Utility DATE 4/13/84
PORT LOCATION SLUDGE INCINERATOR OUTLET
RUN NO. 2 LAB NO. 28-4
OPERATOR/S SNOWDEN
SAMPLE BOX NO. RED METER BOX ΔH@ ____
METER NO. 7-4 TARE ____ Hg

ASA CONSULTANTS

TRAVERSE SAMPLING DATA SHEET

BOX AND PROBE HEATER SETTING ____ &
BAROMETRIC PRESSURE (P_B) 29.72 "Hg
LEAK RATE 0.004 CFM @ 11 BEG "Hg
LEAK RATE 0.000 CFM @ 11 END "Hg
PORT PRESSURE (P_S) -.85 ~~[illegible]~~ "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$ ____ "Hg
ASSUMED MOISTURE ____ % MAX VH ____ "H_2O
C FACTOR ____
REF. ΔP 0.48
STACK DIMENSIONS 19" ID AREA ____ ft^2
PROBE NOZZLE DIA 0.265 IN; AN ____ ft^2
PROBE LENGTH 18" NUMBER 28 SIDE 2

DISTANCE UPSTREAM & DOWNSTREAM FROM OBSTRUCTION ____

5.7 5.5 5.5 = 5.57 INTEGRATED
18.9 18.8 18.9 = 18.87 BAG
18.8 18.9 18.9 = 18.9

15.5 % O2 AFTER DIL, } 15.10
13.25 % O2 BEFORE DILUTION, }

	FINAL WT. gm	INITIAL WT. gm	NET WT. gm
1 BUBBLER	423.9	426.4	= -2.5
2 [illegible]	431.1	426.2	= 4.9
3 BUBBLER	355.1	350.8	= 4.3
4 SILICA GEL	734.2	720.7	= 13.5
TOTAL WATER VOLUME (1gm = 1 ml)			20.2

SCHEMATIC OF TRAVERSE POINT LAYOUT

Cp = 0.822

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL | AVERAGE VALUES READ WITHIN THE TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO2
1335	0	124.708	88	82	225	44							
	3	126.50	90	81	225	46	N 2	0.45	1.7	1.7	1.8	184	
	6	129.10	92	81	230	46	3	0.45	1.7	1.7	1.8	178	4.2,
	9	131.80	93	80	235	47	3	0.47	1.75	1.75	1.9	174	
	12	134.00	94	80	240	47	4	0.54	2.0	1.75	2.0	160	
	15	136.10	96	80	248	47	5	0.64	2.35	2.35	2.5	132	
	18	139.05	99	81	250	47	6	0.83	3.16	3.10	3.0	122	
	21	142.35	103	81	254	48	7	0.99	3.35	3.35	3.5	118	
	24	145.5	107	82	259	52	8	0.91	3.4	3.4	3.5	116	
	27	149.00	110	84	262	52	9	0.91	3.4	3.4	4.0	115	5.7, 18.8, 18.8
1407	30	151.846	111	85	265	53	10	0.90	3.35	3.35	3.8	110	
	33	154.50	111	87	264	52	W 1	0.52	1.90	1.90	2.2	137	
	36	156.95	111	88	262	51	2	0.57	2.1	2.1	2.3	138	
	39	160.00	111	89	261	50	3	0.58	2.15	2.15	2.5	139	
	42	162.65	112	90	257	52	4	0.67	2.5	2.5	2.9	139	4.0, 18.6, 18.7
	45	164.90	113	91	251	53	5	0.73	2.75	2.75	3.2	132	
	48	167.87	116	93	253	53	6	0.77	2.9	2.9	3.5	127	
	51	171.35	119	94	256	52	7	0.81	3.1	3.1	3.6	120	
	54	175.00	120	95	259	54	8	0.85	3.15	3.15	3.9	113	4.8, 18.6, 18.6
	57	177.30	121	95	262	57	9	0.79	2.9	2.9	3.2	108	
1437	60	180.159	122	96	265	58	10	0.79	2.9	2.9	3.3	106	
TOTAL	60	56.192	2239	1815						52.2 "H_2O			
AVERAGE			96.5 °F =	°R					2.61 "H_2O =		"Hg	°R	

$P_m = P_B + \Delta H$ = ____ "Hg

CLIENT Anch. W&WW Util. DATE 9/13/84
PORT LOCATION Sewage Sludge Incin. Stack
RUN NO. 3 LAB NO. 29-4
OPERATOR/S Snowden
SAMPLE BOX NO. Grey METER BOX ΔH@ ____
FILTER NO. 11-4 TARE ____ Mg ____

	FINAL WT. gm	INITIAL WT. gm		NET WT. gm
#1 BUBBLER	415.6	426.3	=	-10.7
#2 IMPINGER	449.1	440.2	=	8.9
#3 BUBBLER	342.7	339.8	=	2.9
#4 SILICA GEL	772.4	749.3	=	23.1

TOTAL WATER VOLUME (1gm = 1 ml) 24.2

ASA CONSULTANTS

TRAVERSE SAMPLING DATA SHEET

DISTANCE UPSTREAM & DOWNSTREAM FROM OBSTRUCTION ____ ____

5.5 5.5 5.6
18.9 18.8 18.9
18.9 18.8 18.9

17.4% O2 @ Stack After Dil
15.2% O2 @ Before Dilution

SCHEMATIC OF TRAVERSE POINT LAYOUT

BOX AND PROBE HEATER SETTING ____
BAROMETRIC PRESSURE (P_B) 29.78 "Hg
LEAK RATE 0.002 CFM @ 9" END "HG
0.005 CFM @ 11" BEG
PORT PRESSURE (P_S) -.45 "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$ ____ "Hg
ASSUMED MOISTURE 2 % MAX VH ____ "H_2O
C FACTOR 1.1
REF. ΔP 0.38
STACK DIMENSIONS 19" Ø AREA ____ F2
PROBE NOZZLE DIA. 0.265 IN; A_N ____ F2
PROBE LENGTH 16 NUMBER 28 SIDE 2

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL

AVERAGE VALUES READ WITHIN THE TIME INTERVAL Cp = 0.822

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F)		BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O)		PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2
			INLET	OUTLET					DESIRED	ACTUAL			
1559	0	181.088	86	79	225	58	W1	0.49	2.35	2.35	2.5	145	
	3	183.76	87	79	226	57	2	0.55	2.6	2.6	2.9	145	5.1, 18.9, 18.9
	6	186.60	89	79	230	55	3	0.63	3.05	3.05	3.3	146	
	9	189.55	93	79	240	54	4	0.69	3.36	3.35	3.7	155	
	12	192.75	96	79	250	54	5	0.69	3.35	3.35	3.7	150	
	15	195.65	100	79	260	55	6	0.81	4.0	4.0	4.6	139	
	18	199.50	102	79	262	58	7	0.87	4.2	4.2	5.0	130	
	21	202.90	105	80	269	60	8	0.91	4.35	4.35	5.5	118	
	24	206.80	107	81	275	63	9	0.91	4.35	4.35	5.5	113	4.8, 18.8, 18.8
	27	210.40	109	82	262	63	10	0.87	4.2	4.2	5.2	108	
/1632	30	213.695	111	84	250	64	N1	0.44	2.15	2.15	2.6	190	
	33	216.25	110	84	250	64	2	0.48	2.35	2.35	3.0	198	4.9, 18.8, 18.8
	36	219.40	109	85	247	65	3	0.62	3.0	3.00	3.5	186	
	39	222.00	111	86	245	65	4	0.70	3.4	3.4	4.1	179	
	42	225.25	113	87	240	65	5	0.91	4.35	4.35	5.2	132	
	45	228.75	114	88	250	66	6	0.96	4.6	4.6	6.2	118	
	48	232.50	115	88	240	66	7	0.96	4.6	4.6	6.8	108	
	51	236.35	117	89	240	66	8	0.96	4.6	4.6	7.5	104	
	54	240.10	119	91	255	67	9	0.96	4.6	4.6	7.5	102	
	57	243.65	120	92	250	69	10	0.92	4.3	4.3	7.5	102	4.9, 18.9, 18.9
1702	60	245.982	121	92	245	72							
TOTAL	60	64.894	2234	1962						73.75 "H_2O			
AVERAGE			95.1 °F =	°R					3.69 "H_2O =	"Hg		°R	

$P_m = P_B + \Delta H$ = ____ "Hg

OURCE NAME Pt. Woronzof STP Incinerator

SOURCE ID NUMBER 8321-AA007

OBSERVATION DATE 4/13/84

DDRESS 2300 Hutson Dr

OBSERVER'S NAME (PRINT) Bill MacClarence

ORGANIZATION AK Dept of Env. Conserv

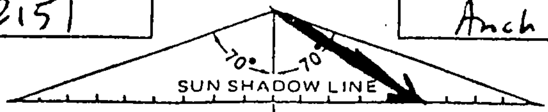
TATE AK

ZIP 99503

PHONE 243-2151

CERTIFIED BY Anch Air Poln Control Agency

DATE 10/27/83



ROCESS Sludge Incinerator

OPERATING MODE

ONTROL EQUIPMENT wet scrubber

OPERATING MODE

ESCRIBE EMISSION POINT stack exit after dilution air

MISSION POINT HEIGHT BOVE GROUND LEVEL 35'

EMISSION POINT HEIGHT RELATIVE TO OBSERVER 40'

ISTANCE TO MISSION POINT 150'

DIRECTION TO EMISSION POINT NNE

ESCRIBE EMISSIONS straight well defined plume

OLOR OF EMISSIONS black to yellow

CONTINUOUS ☑ FUGITIVE ☐

INTERMITTENT ☐

ATER VAPOR PRESENT O ☑ YES ☐

IF YES, IS PLUME ATTACHED ☐ N/A DETACHED ☐

T WHAT POINT WAS OPACITY DETERMINED stack exit

ESCRIBE BACKGROUND overcast sky

OLOR OF BACKGROUND white

SKY CONDITIONS overcast

IND SPEED 0-5

WIND DIRECTION S

MBIENT TEMPERATURE 40

RELATIVE HUMIDITY

OMMENTS during run No. [illegible] source test

transmissometer reading 8%

START TIME 1043

STOP TIME 1102

	0	15	30	45		0	15	30	45
1	5	0	0	5	31				
2	5	5	5	10	32				
3	5	5	5	5	33				
4	5	0	5	5	34				
5	5	10	5	5	35				
6	5	5	10	5	36				
7	5	0	5	5	37				
8	10	0	5	0	38				
9	0	5	0	5	39				
10	0	0	5	0	40				
11	0	0	0	0	41				
12	0	5	10	5	42				
13	0	0	0	0	43				
14	5	0	0	0	44				
15	5	10	0	0	45				
16	0	0	10	5	46				
17	5	5	0	15	47				
18	5	5	5	0	48				
19	5	0	5	0	49				
20	0	0	5	0	50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

AVERAGE OPACITY 3.0%

NUMBER OF READINGS ABOVE 20 % WERE none

RANGE OF OPACITY READINGS FROM 0 TO 15

OURCE LAYOUT SKETCH

DRAW NORTH ARROW

BSERVER'S SIGNATURE

DATE 4/12/84

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.

SIGNATURE

ERIFIED BY

TITLE

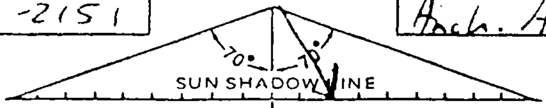
DATE / /

SOURCE NAME Pt. Woronzof STP Incinerator	SOURCE ID NUMBER 0321-AA007	OBSERVATION DATE 4/13/84
ADDRESS 3200 Hutson Dr	OBSERVER'S NAME (PRINT) Bill MacClarence	
	ORGANIZATION AK Dept of Env. Conserv.	

STATE	ZIP	PHONE
AK	94503	243-2151

CERTIFIED BY Anch. Air Poln Control Agency

DATE 10/27/84



PROCESS sludge incinerator	OPERATING MODE
CONTROL EQUIPMENT wet scrubber	OPERATING MODE
DESCRIBE EMISSION POINT stack exit after dilution air	
EMISSION POINT HEIGHT ABOVE GROUND LEVEL 35'	EMISSION POINT HEIGHT RELATIVE TO OBSERVER 45'
DISTANCE TO EMISSION POINT 180'	DIRECTION TO EMISSION POINT NE
DESCRIBE EMISSIONS straight well defined plume	
COLOR OF EMISSIONS brown/yellow	CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐
WATER VAPOR PRESENT NO ☑ YES ☐	IF YES, IS PLUME ATTACHED ☐ N/A DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED stack exit	
DESCRIBE BACKGROUND Overcast sky	
COLOR OF BACKGROUND white	SKY CONDITIONS overcast
WIND SPEED 0-5	WIND DIRECTION E
AMBIENT TEMPERATURE 50	RELATIVE HUMIDITY

COMMENTS during run No. 3 source test

transmissometer reading 0%

START TIME 1608 STOP TIME 1627

	0	15	30	45		0	15	30	45
1	5	5	5	5	31				
2	10	5	0	5	32				
3	5	5	5	5	33				
4	0	5	0	5	34				
5	5	5	0	10	35				
6	5	5	0	0	36				
7	0	5	5	0	37				
8	5	5	0	0	38				
9	0	0	0	5	39				
10	5	10	0	5	40				
11	0	5	0	5	41				
12	5	5	0	0	42				
13	0	0	0	0	43				
14	0	0	0	5	44				
15	0	0	0	0	45				
16	5	0	0	10	46				
17	5	0	0	0	47				
18	0	0	5	5	48				
19	0	0	5	5	49				
20	5	0	0	0	50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

AVERAGE OPACITY 2.1%	NUMBER OF READINGS ABOVE 20 % WERE none
RANGE OF OPACITY READINGS FROM 0 TO 10	

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW

OBSERVER'S SIGNATURE	DATE 4/13/84
VERIFIED BY	

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.

SIGNATURE

TITLE

DATE / /

PITOT TUBE IDENTIFICATION NUMBER: #28 DATE: 4/18/84
CALIBRATED BY: W. D. SNOWDEN

	"A" SIDE CALIBRATION (#1)			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	0.98	1.4	0.828	0.006
2	0.52	0.74	0.830	0.008
3	0.04	0.06	0.808	0.01
		$\bar{C}_p$ (SIDE A)	0.822	

	"B" SIDE CALIBRATION (#2)			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	0.98	1.40	0.828	0.006
2	0.52	0.74	0.830	0.008
3	0.04	0.06	0.808	0.01
		$\bar{C}_p$ (SIDE B)	0.822	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

DRY GAS METER AND ORIFICE CALIBRATION LOG

Meter Box No. #1

Dry Gas Meter Identification Meter Box #1

Date 4/17/84

Barometric Pressure, Pb 29.8 In. HG

Technician W. D. Snowden

Orifice Manometer Setting, ΔH, in H_2O	Gas Volume Wet Test Meter Vw, ft^3	Gas Volume Dry Gas Meter Vd, ft^3	Temperature: Wet Test Meter tw °F	Temperature: Dry Gas Meter Inlet tdi, °F	Temperature: Dry Gas Meter Outlet tdo, °F	Temperature: Dry Gas Meter Average td, °F	Time θ min.	Y	ΔH@
0.5	5	5.14	64.5	87.5	76.5	82	13.6	1.004	2.011
1.0	5	5.272	64	96.5	84	90.25	9.3	0.993	1.852
2.0	10	10.628	63.5	108	89.5	97.5	12.8	0.997	1.733
4.0	10	10.738	63.5	119	95.5	107.25	9.1	0.999	1.733
6.0	10	10.757	63.5	125.5	99.5	112.5	7.5	1.002	1.753
	10								
							Average	0.999	1.8164

Calculations

ΔH	$\frac{\Delta H}{13.6}$	Y: $\frac{V_w P_b (t_d + 460)}{V_d (P_b + \Delta H/13.6)(t_w + 460)}$	ΔH@: $\frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\theta}{V_w}\right]^2$
		$\frac{(\ )(\ )(\ )}{(\ )(\ )(\ )} =$	$\frac{0.0317\ (\ )}{(\ )(\ )} \left[\frac{\ }{\ }\right]^2 =$
		$\frac{(\ )(\ )(\ )}{(\ )(\ )(\ )} =$	$\frac{0.0317\ (\ )}{(\ )(\ )} \left[\frac{\ }{\ }\right]^2 =$
		$\frac{(\ )(\ )(\ )}{(\ )(\ )(\ )} =$	$\frac{0.0317\ (\ )}{(\ )(\ )} \left[\frac{\ }{\ }\right]^2 =$
		$\frac{(\ )(\ )(\ )}{(\ )(\ )(\ )} =$	$\frac{0.0317\ (\ )}{(\ )(\ )} \left[\frac{\ }{\ }\right]^2 =$
		$\frac{(\ )(\ )(\ )}{(\ )(\ )(\ )} =$	$\frac{0.0317\ (\ )}{(\ )(\ )} \left[\frac{\ }{\ }\right]^2 =$
		$\frac{(\ )(\ )(\ )}{(\ )(\ )(\ )} =$	$\frac{0.0317\ (\ )}{(\ )(\ )} \left[\frac{\ }{\ }\right]^2 =$

Y = Ratio of accuracy of wet test meter to dry test meter. Tolerance = ±0.01

ΔH@ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in H_2O. Tolerance = ±0.15

Hearth	Temp (°F)	No. of Gas Burners
1	1000 (538°C)	2
2	1250	2
3	1250 (677°C)	—
4	1400 (760°C)	2
5	900-1400	2
6	500 max	—

rec'd @ plant
4/13/83

sent to TRW
& EPA

40 gpm H_2O precooler
00 gpm H_2O scrubber

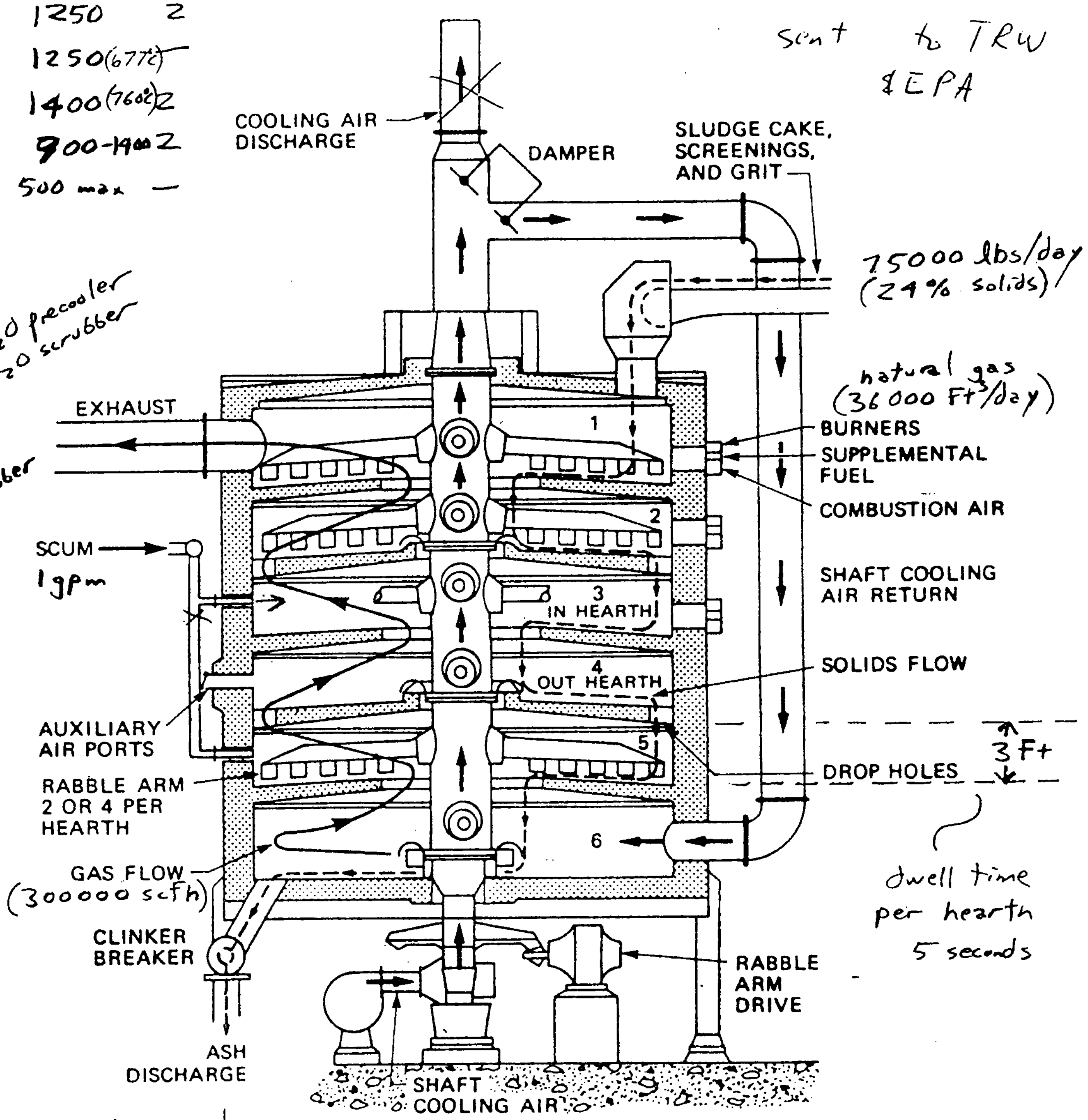


FIGURE 11-6

CROSS SECTION OF A MULTIPLE-HEARTH FURNACE

14 Ft 3½ in

BSP - Envirotech
Furnace No. 71343
Job No. 5737
Contract #12, phase 2
Lurgi (Parent Co.)
Belmont, Calif.

WESLEY D. SNOWDEN, P.E. FEBRUARY 1984

Mr. Snowden is the founder and principal of ASA CONSULTANTS. Prior to forming ASA, Mr. Snowden was Manager of the Environmental Services Department of Valentine, Fisher and Tomlinson for seven years and was a Sanitary Engineer with the U.S. Environmental Protection Agency (EPA) for three years. Mr. Snowden directs and performs air quality modeling, monitoring and source evaluation, training, energy optimization, economic feasibility, professional services management, and control system design services of ASA CONSULTANTS. Projects performed for industrial clients include reduction of atmospheric emissions, industrial waste water discharges, solid wastes, occupational workroom pollutants, and noise levels.

Mr. Snowden is a certified Diplomat in the American Academy of Environmental Engineers and a member in the Air Pollution Control Association, American Society of Civil Engineers, Source Evaluation Society, American Management Association, the National Society of Professional Engineers and American Institute of Professional Consultants. Mr. Snowden was a founder and served as the first president (1974) of the Source Evaluation Society (SES). The SES is an international association of professionals who perform air quality and source evaluations and strive to enhance the state-of-the-art. Mr. Snowden served in the past as Editor of "Stack Sampling News", a nation-wide monthly publication, and is listed in "Who's Who in Engineering" and "Who's Who in the West".

Mr. Snowden holds a Masters Degree in Business Administration from Seattle University and a Bachelor of Science Degree in Civil Engineering from the University of Washington. Mr. Snowden has presented training courses and authored numerous technical articles on air quality studies, atmospheric emissions from combustion sources, energy optimization of combustion sources, sampling data reporting and calculations and management of professional-technical service organizations. Mr. Snowden is a certified opacity reader from the State of Washington.

Mr. Snowden has served as an expert witness on legal suits wherein disputes have arisen between the purchaser and manufacturer of air pollution control equipment. Testimony provided by Mr. Snowden included evaluation of testing results, equipment specifications and installation performance. Mr. Snowden authored a chapter titled "Parameters to Evaluate for Specifying Air Pollution Control Equipment" in a book by Young and Cross published in 1982 by Marcel Dekker, Inc. of New York, N.Y. Mr. Snowden is publishing a book on "Tuning Small Boilers for Energy Optimization"